AMENDMENTS

In the Claims:

Please amend the claims as indicated hereafter.

1. (Previously Presented) An apparatus for correlated noise reduction, the apparatus comprising:

a trellis decoder, the trellis decoder operative to provide decoded data and a trellis error signal, the trellis error signal formed as a decision error of a selected previous state of a selected trellis path;

a linear feedforward equalizer, the linear feedforward equalizer having as input a received data signal, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the trellis error signal to modify a first plurality of equalization coefficients a(n); and

a noise predictor, the noise predictor operatively coupled to the linear feedforward equalizer to provide an input to the trellis decoder, the noise predictor having as input a tentative error signal, the tentative error signal formed as a difference between a tentative symbol decision by the trellis decoder and a delayed received data signal subsequent to equalization, the noise predictor operatively coupled to the trellis decoder for adaptation to the trellis error signal to modify a plurality of correlated noise reduction coefficients c(n).

2. (Original) The apparatus of claim 1, wherein the trellis decoder is further operative to determine a plurality of trellis paths, to determine a cumulative error associated with each trellis path to the plurality of trellis paths, and to select a trellis path, from the plurality of trellis paths, having a smallest cumulative error, to form the selected trellis path.

3. (Original) The apparatus of claim 1, wherein the trellis decoder is further operative to select an immediately previous state of the selected trellis path to form the selected previous state.

4. (Original) The apparatus of claim 1, wherein the tentative symbol decision and the delayed received data signal subsequent to equalization have one symbol time delay.

5. (Original) The apparatus of claim 1, wherein for precoded data, an output of the linear feedforward equalizer is filtered utilizing a transfer function of $(1+C(z))$, wherein $C(z)$ is a z-transform of the correlated noise reduction coefficients $c(n)$.

6. (Original) The apparatus of claim 1, further comprising:

a decision feedback adaptive filter operatively coupled to an output of the linear feedforward equalizer.

7. (Original) The apparatus of claim 6, wherein for precoded data:

the trellis decoder further has a symbol decider operative during a training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to equalization and correlated noise reduction;

the linear feedforward equalizer further has as input the received training signal during the training mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide the first plurality of coefficient $a(n)$ for equalization;

the decision feedback adaptive filter is further operatively coupled to the symbol decider for input of the symbol decision, for adaptation to the first training error signal and to provide a second plurality of equalization coefficients b(n); and

the noise predictor, further having an output operatively coupled to a combined output of the linear feedforward equalizer and the decision feedback adaptive filter to provide an input to the symbol decider, the noise predictor having as input a second training error signal, the second training error signal error signal formed as a difference between the symbol decision and the received training signal subsequent to equalization, and the noise predictor operatively coupled to the symbol decider for adaptation to the first training error signal to provide the plurality of correlated noise reduction coefficients c(n).

8. (Original) The apparatus of claim 7, further comprising:

a processor operatively coupled to the decision feedback adaptive filter and to the noise predictor, wherein the processor, when operative, is configured to determine a plurality of precoding coefficients t(n) as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) (t(n) = b(n) + c(n) + b(n)*c(n)); and

wherein the processor is further configured to transfer the plurality of precoding coefficients t(n) to a transmitter for precoding of data for transmission.

9. (Original) The apparatus of claim 7, further comprising:

a first transmitter configured to transfer the plurality of equalization coefficients b(n) and the plurality of correlated noise reduction coefficients c(n) to a second transmitter for precoding using a plurality of precoding coefficients t(n) determined by the second transmitter as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) (t(n) = b(n) + c(n) + b(n)*c(n)).

10. (Original) The apparatus of claim 1, wherein for non-precoded data:

the trellis decoder further has a symbol decider operative during a training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to equalization and correlated noise reduction;

the linear feedforward equalizer further has as input the received training signal during the training mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide the first plurality of coefficients a(n) for equalization; and

the noise predictor further has as input a second training error signal, the second training error signal formed as a difference between the symbol decision and the received training signal subsequent to equalization, and the noise predictor operatively coupled to the symbol decider for adaptation to the first training error signal to provide the plurality of correlated noise reduction coefficients c(n).

11. (Original) The apparatus of claim 1, wherein the noise predictor is embodied as a linear adaptive filter operative with at least mean square algorithm.

12. (Original) An apparatus for correlated noise reduction, the apparatus having a training mode and having a data mode, the apparatus operative during training mode to receive a training signal from a transmitter and operative during data mode to receive a data signal from the transmitter, the apparatus comprising:

a trellis decoder, the trellis decoder having a symbol decider operative during the training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to equalization and correlated noise reduction, the trellis decoder operative during the data mode to provide decoded data and a trellis error signal, the trellis error signal formed as a decision error of a selected previous state of a selected trellis path;

a linear feedforward equalizer, the linear feedforward equalizer having as input the received training signal during the training mode and a received data signal during data mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide a first plurality of coefficients a(n) for equalization and for adaptation to the trellis error signal during data mode to modify the first plurality of coefficients a(n) for adaptive equalization;

a training mode adaptive distortion and correlated noise canceller operative during training mode, an output of the training mode adaptive distortion and correlated noise canceller operatively coupled to an output of the linear feedforward equalizer to provide an input to the symbol decider of the trellis decoder, the training mode adaptive distortion and correlated noise canceller having as input a second training error signal, the second training error signal formed as a difference between

- 6 -

the symbol decision and the received training signal subsequent to equalization, the training mode adaptive distortion and correlated noise canceller operatively coupled to the trellis decoder for adaptation to the first training error signal to provide a second plurality of coefficients b(n) for equalization and a third plurality of coefficients c(n) for correlated noise reduction; and

a data mode adaptive correlated noise canceller operative during data mode, an output of the data mode adaptive correlated noise canceller operatively coupled to a filter output of the linear feedforward equalizer to provide an input to the trellis decoder, the data mode adaptive correlated noise canceller having as input a tentative error signal, the tentative error signal formed as a difference between a tentative symbol decision and a delayed received data signal subsequent to equalization, the data mode adaptive correlated noise canceller operatively coupled to the trellis decoder for adaptation to the trellis error signal during data mode to modify the third plurality of coefficients c(n) for adaptive correlated noise reduction.

13. (Original) The apparatus of claim 12, wherein the trellis decoder is further operative during data mode to determine a plurality of trellis paths, to determine a cumulative error associated with each trellis path of the plurality of trellis paths, and to select a trellis path, from the plurality of trellis paths, having a smallest cumulative error, to form the selected trellis path.

14. (Original) The apparatus of claim 12, wherein the trellis decoder is further operative to select an immediately previous state of the selected trellis path to form the selected previous state.

15. (Original) The apparatus of clam 12, wherein the data mode adaptive correlated noise canceller is further operative, when data has been precoded, to reset the third plurality of coefficients c(n) to zero subsequent to training mode and prior to data mode.

- 7 -

16. (Original) The apparatus of claim 12, wherein the tentative symbol decision and the delayed received data signal subsequent to equalization have one symbol time delay.

17. (Original) The apparatus of claim 12, further comprising:

a processor coupled to the training mode adaptive distortion and correlated noise canceller, wherein the processor, when operative, is configured to determine a fourth plurality of coefficients $t(n)$ as equal to a sum of the second plurality of coefficients $b(n)$ plus the third plurality of coefficients $c(n)$ plus the result of a convolution of the second plurality of coefficients $b(n)$ with the third plurality of coefficients $c(n)$ ($t(n) = b(n) + c(n) + b(n)*c(n)$), and wherein the processor is further configured to transfer the fourth plurality of coefficients $t(n)$ to the transmitter for precoding of data for transmission.

18. (Original) The apparatus of claim 12, wherein the training mode adaptive distortion and correlated noise canceller is further configured to transfer the second plurality of coefficients $b(n)$ and the third plurality of coefficients $c(n)$ to the transmitter for precoding using a fourth plurality of coefficients $t(n)$, the fourth plurality of coefficients $t(n)$ determined by the transmitter as equal to a sum of the second plurality of coefficients $b(n)$ plus the third plurality of coefficients $b(n)$ with the third plurality of coefficients $c(n)$ ($t(n) + b(n) + c(n) + b(n)*c(n)$).

19. (Original) The apparatus of claim 12, wherein the filtered output of the linear feedforward equalizer is generated by a filter having a transfer function of $(1+C(z))$, wherein $C(z)$ is a z-transform of the third plurality of coefficients $c(n)$.

20. (Original) The apparatus of claim 12, wherein the training mode adaptive distortion and correlated noise canceller further comprises:

a decision feedback adaptive filter operatively coupled to an output of the linear feedforward equalizer, the decision feedback adaptive filter operatively coupled the symbol decider for input of the symbol decision, for adaptation to the first training error signal and to provide the second plurality of coefficients b(n) for equalization; and

a noise predictor, the noise predictor having an output operatively coupled to a combined output of the linear feedforward equalizer and the decision feedback adaptive filter to provide an input to the symbol decider, the noise predictor having as input the second training error signal, and the noise predictor operatively coupled to the symbol decider for adaptation to the first training error signal to provide the third plurality of coefficients c(n) for correlated noise reduction.

21. (Original) A method of correlated noise reduction, the method comprising:

(a) receiving a data signal to form a received data signal;

(b) determining a trellis error signal as a decision error of a selected previous state of a selected trellis path;

(c) equalizing a received data signal utilizing a first plurality of equalization coefficients a(n) to form an equalized data signal and modifying the first plurality of equalization coefficients a(n) in response to the trellis error signal;

(d) determining a tentative error signal as a difference between a tentative symbol decision and a delayed equalized data signal;

(e) reducing correlated noise in the equalized data signal utilizing a plurality of correlated noise reduction coefficients c(n) and modifying the plurality of correlated noise reduction coefficients c(n) in response to the trellis error signal and with input of the tentative error signal.

22. (Original) The method of claim 21, wherein step (b) further comprises:

determining a plurality of trellis paths;

determining a cumulative error associated with each trellis path of the plurality of trellis paths; and

selecting a trellis path, from the plurality of trellis paths, having a smallest cumulative error, to form the selected trellis path.

23. (Original) The method of claim 21, wherein step (b) further comprises:

selecting an immediately previous state of the selected trellis path to form the selected previous state.

24. (Original) The method of claim 21, wherein step (d) further comprises:

selecting the tentative symbol decision and the delayed equalized data signal having one symbol time delay.

25. (Original) The method of claim 21, wherein step (c) further comprises:

filtering the equalized data signal utilizing a transfer function of $(1 + C(z))$, wherein $C(z)$ is a z-transform of the correlated noise reduction coefficients $c(n)$.

26. (Original) The method of claim 21, further comprising:

trellis decoding the received data signal subsequent to equalization and correlated noise reduction.

27. (Original) The method of claim 21, further comprising, prior to step (a):

receiving a training signal to form a received training signal;

determining a first training error signal as a difference between a symbol decision and the received training signal subsequent to equalization and correlated noise reduction;

determining the first plurality of equalization coefficients a(n) using the received training signal and with adaptation to the first training error signal;

determining a second plurality of equalization coefficients b(n) using the symbol decision and with adaptation to the first training error signal;

determining a second training error signal as a difference between the symbol decision and the received training signal subsequent to equalization; and

determining the plurality of correlated noise reduction coefficients c(n) for correlated noise reduction using the second training error signal and with adaptation to the first training error signal.

28. (Original) The method of claim 27, further comprising:

determining a plurality of precoding coefficients t(n) as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) t(n) = B(n) + c(n) + b(n)*c(n)).

29. (Original) The method of claim 21, further comprising, prior to step (a):

receiving a training signal to form a received training signal;

determining a first training error signal as a difference between a symbol decision and the received training signal subsequent to equalization and correlated noise reduction;

determining a second training error signal as a difference between the symbol decision and the received training signal subsequent to equalization; and

determining the plurality of correlated noise reduction coefficients $c(n)$ for correlated noise reduction using the second training error signal and with adaptation to the first training error signal.

30. (Original) An apparatus for correlated noise reduction, the apparatus comprising:

means for receiving a data signal to form a received data signal;

means for determining a trellis error signal as a decision error of a selected previous state of a selected trellis path;

means for equalizing a received data signal utilizing a first plurality of equalization coefficients $a(n)$ to form an equalized data signal and modifying the first plurality of equalization coefficients $a(n)$ in response to the trellis error signal;

means for determining a tentative error signal as a difference between a tentative symbol decision and a delayed equalized data signal;

means for reducing correlated noise in the equalized data signal utilizing a plurality of correlated noise reduction coefficients $c(n)$ and modifying the plurality of correlated noise reduction coefficients $c(n)$ in response to the trellis error signal and with input of the tentative error signal.

31. (Original) The apparatus of claim 30, further comprising:

means for determining a plurality of trellis paths;

means for determining a cumulative error associated with each trellis path of the plurality of trellis paths; and

means for selecting a trellis path, from the plurality of trellis paths, having a smallest cumulative error, to form the selected trellis path.

32. (Original) The apparatus of claim 30, further comprising:

means for selecting an immediately previous state of the selected trellis path to from the selected previous state.

33. (Original) The apparatus of claim 30, further comprising:

means for selecting the tentative symbol decision and the delayed equalized data signal having one symbol time delay.

34. (Original) The apparatus of claim 30, further comprising:

means for filtering the equalized data signal utilizing a transfer function of $(1+C(z))$, wherein $C(z)$ is a z-transform of the correlated noise reduction coefficients $c(n)$.

35. (Original) The apparatus of claim 30, further comprising:

means for trellis decoding the received data signal subsequent to equalization and correlated noise reduction.

36. (Original) The apparatus of claim 30, further comprising:

means for receiving a training signal to form a received training signal;

means for determining a first training error signal as a difference between a symbol decision and the received training signal subsequent to equalization and correlated noise reduction;

means for determining the first plurality of equalization coefficients a(n) using the received training signal and with adaptation to the first training error signal;

means for determining a second plurality of equalization coefficients b(n) using the symbol decision and with adaptation to the first training error signal;

means for determining a second training error signal as a difference between the symbol decision and the received training signal subsequent equalization; and

means for determining the plurality of correlated noise reduction coefficients c(n) for correlated noise reduction using the second training error signal and with adaptation to the first training error signal.

37. (Original) The apparatus of claim 36, further comprising:

means for determining a plurality of precoding coefficients t(n) as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) (t(n) = + c(n) + b(n)*c(n)).

38. (Original) The apparatus of claim 30, further comprising:

means for receiving a training signal to form a received training signal;

means for determining a first training error signal as a difference between a symbol decision and the received training signal subsequent to equalization and correlated noise reduction;

means for determining the first plurality of equalization coefficients a(n) using the received training signal and with adaptation to the first training error signal;

means for determining a second training error signal as a difference between the symbol decision and the received training signal subsequent to equalization; and

means for determining the plurality of correlated noise reduction coefficients c(n) for correlated noise reduction using the second training error signal and with adaptation to the first training error signal.

39. (Previously Presented) A system for reduction of correlated noise during data transmission, the system comprising:

a transmitter, the transmitter operative to transmit a training signal and to transmit a data signal; and

a receiver couplable to the transmitter via a communication channel, the receiver further comprising:

a trellis decoder, the trellis decoder operative to provide decoded data and a trellis error signal, the trellis error signal formed as a decision error of a selected previous state of a selected trellis path;

a linear feedforward equalizer, the linear feedforward equalizer having as input a received

data signal, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation

to the trellis error signal to modify a first plurality of equalization coefficients a(n); and

a noise predictor, the noise predictor operatively coupled to the linear feedforward equalizer

to provide an input to the trellis decoder, the noise predictor having as input a tentative error signal,

the tentative error signal formed as a difference between a tentative symbol decision by the trellis

decoder and a delayed received data signal subsequent to equalization, the noise predictor operatively

coupled to the trellis decoder for adaptation to the trellis error signal to modify a plurality of

correlated noise reduction coefficients c(n).

40. (Original) The system of claim 39, wherein the trellis decoder is further operative to

determine a plurality of trellis paths, to determine a cumulative error associated with each trellis path

of the plurality of trellis paths, and to select a trellis path, from the plurality of trellis paths, having a

smallest cumulative error, to form the selected trellis path.

41. (Original) The system of claim 39, wherein the trellis decoder is further operative to

select an immediately previous state of the selected trellis path to form the selected previous state.

42. (Original) The system of claim 39, wherein the tentative symbol decision and the

delayed received data signal subsequent to equalization are selected at a time of one symbol time

delay.

43. (Original) The system of claim 39, wherein for precoded data, an output of the linear feedforward equalizer is filtered utilizing a transfer function of $(1 + C(z))$, wherein $C(z)$ is a z-transform of the correlated noise reduction coefficients $c(n)$.

44. (Original) The system of claim 39, wherein the receiver further comprises:

a decision feedback adaptive filter operatively coupled to an output of the linear feedforward equalizer.

45. (Original) The system of claim 39, wherein for precoded data:

the trellis decoder further has a symbol decider operative during a training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to equalization and correlated noise reduction;

the linear feedforward equalizer further has as input the received training signal during the training mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide the first plurality of coefficients $a(n)$ for equalization;

the decision feedback adaptive filter is further operatively coupled to the symbol decider for input of the symbol decision, for adaptation to the first training error signal and to provide a second plurality of equalization coefficients $b(n)$; and

the noise predictor, further having an output operatively coupled to a combined output of the linear feedforward equalizer and the decision feedback adaptive filter to provide an input to the symbol decider, the noise predictor having as input a second training error signal, the second training error signal formed as a difference between the symbol decision and the received training signal

subsequent to equalization, and the noise predictor operatively coupled to the symbol decider for adaptation to the first training error signal to provide the plurality of correlated noise reduction coefficients c(n).

46. (Original) The system of claim 45, further comprising:

a processor operatively coupled to the decision feedback adaptive filter and to the noise predictor, wherein the processor, when operative, is configured to determine a plurality of precoding coefficients t(n) as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) (t(n) = b(n) + c(n) + b(n)*c(n)); and

wherein the processor is further configured to transfer the plurality of precoding coefficients t(n) to the transmitter for precoding of data for transmission to form the data signal.

47. (Original) The system of claim 45, wherein the transmitter is further configured for precoding of data for transmission to form the data signal using a plurality of precoding coefficients t(n) determined by the transmitter as equal to a sum of the second plurality of equalization coefficients b(n) plus the plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients c(n) (t(n) = b(n) + c(n) + b(n)*c(n)).

48. (Original) The system of claim 39, wherein for non-precoded data:

the trellis decoder further has a symbol decider operative during a training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to equalization and correlated noise reduction;

the linear feedforward equalizer further has as input the received training signal during the training mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide the first plurality of coefficients a(n) for equalization; and

the noise predictor further has as input a second training error signal, the second training error signal formed as a difference between the symbol decision and the received training signal subsequent to equalization, and the noise predictor operatively coupled to the symbol decider for adaptation to the first training error signal to provide the plurality of correlated noise reduction coefficients c(n).

49-56. (Canceled)

57. (Original) An apparatus for correlated noise reduction, the apparatus having a training mode and having a data mode, the apparatus operative during training mode to receive a training signal from a transmitter and operative during data mode to receive a data signal from the transmitter, the apparatus comprising:

a trellis decoder, the trellis decoder having a symbol decider operative during the training mode to provide a symbol decision and a first training error signal, the first training error signal formed as a difference between the symbol decision and a received training signal subsequent to

equalization and correlated noise reduction, the trellis decoder operative during the data mode to provide decoded data and a trellis error signal, the trellis error signal being a decision error of an immediately previous state of a selected trellis path of a plurality of trellis paths, the selected trellis path having a smallest cumulative error of the plurality of trellis paths;

a linear feedforward equalizer, the linear feedforward equalizer having as input the received training signal during the training mode and a received data signal during data mode, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide a first plurality of equalization coefficients a(n) and for adaptation to the trellis error signal during data mode to modify the first plurality of equalization coefficients a(n) for adaptive equalization,

a decision feedback adaptive filter operatively coupled to an output of the linear feedforward equalizer and operatively coupled to the symbol decider for input of the symbol decision, for adaptation to the first training error signal and to provide a second plurality of equalization coefficients b(n) for data transmission precoding;

a noise predictor, the noise predictor operatively coupled to combined output of the linear feedforward equalizer and the decision feedback adaptive filter to provide an input to the trellis decoder, the noise predictor, having as input a second training error signal during training mode, the second training error signal formed as a difference between the symbol decision and the received training signal subsequent to equalization, the noise predictor operatively coupled to the trellis decoder for adaptation to the first training error signal during training mode to provide a plurality of correlated noise reduction coefficients c(n) for data transmission precoding, the noise predictor further having as input a tentative error signal during data mode, the tentative error signal formed as a difference between a tentative symbol decision and a delayed received data signal subsequent to equalization, the tentative symbol decision and the delayed received data signal subsequent to

equalization having one symbol time delay, the noise predictor further operatively coupled to the

trellis decoder for adaptation to the trellis error signal during data mode to initially reset the plurality

of correlated noise reduction coefficients c(n) to zero and to subsequently modify the plurality of

correlated noise reduction coefficients c(n) for adaptive correlated noise reduction; and

a processor operatively coupled to the decision feedback adaptive filter and to the noise

predictor, wherein the processor, when operative, is configured to determine a plurality of precoding

coefficients t(n) as equal to a sum of the second plurality of equalization coefficients b(n) plus the

plurality of correlated noise reduction coefficients c(n) plus the result of a convolution of the second

plurality of equalization coefficients b(n) with the plurality of correlated noise reduction coefficients

c(n) (t(n) = b(n) + c(n) + B(n)*c(n)), and wherein the processor is further configured to transfer the

plurality of precoding coefficients t(n) to the transmitter for precoding of data for transmission.

58-64. (Canceled)